

# A review on chemical fingerprinting of marine lubricants for oil spill identification

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## I. Introduction

### Scope of this study

- Modern merchant vessels utilize a variety of lubricants below related
  - > to reduce friction on bearing surfaces in engines, engine shafts, etc.
  - > to drive hydraulically driven winches, cranes, and other heavy equipment
- In case of accidentally or intentionally spill of onboard lubricants(or the accumulated waste oils stored in holding tanks), the forensic investigator must have knowledge of the basic chemical features of the lubricants differentiate from petroleum products and crude oils
- This study provides a brief overview of basic chemical fingerprinting of lubricants

## II. Chemical fingerprinting of lubricants

### Biomarkers

- Petroleum biomarker compounds, unlike PAHs, are abundant in unused and used lubricating oils
  - offer chemical fingerprinting such as diagnostic chemical features of spill oils
  - The variability of biomarker concentration oils can be used to differentiate lubricants in the environment
  - A relative amounts of 18a-22,29,30-trisnorneohopane(Ts) and 18a-22,29,30, trisnorneohopane(Tm) such as diagnostic ratios
  - A cross-plot of the diagnostic biomarker ratios Ts/hopane versus Ts/Tm

## II. Chemical fingerprinting of lubricants

### Gas Chromatograph method

- There are several common features among all of the lubricants
  - High boiling oils with initial boiling points greater than C<sub>15</sub> ; thermal stability, low volatility and high viscosity
  - the shape of UnresolvedComplexMixture(UCM) is typically symmetrical and near-Gaussians ; similar boiling range distribution
  - Few meaningful resolved gas chromatographic peaks superimposed on UCM ; this is because normal and branched chain alkanes prominent in most crude oil have been removed during the dewaxing of the base oils

## III. Conclusions

- The useful tools for chemical fingerprinting in lubricating oils spill
  - The distinctive near-Gaussian UCM with the C<sub>15</sub>~C<sub>45</sub> carbon range and few significant resolved peaks
  - The shape(symmetry, width, and apex) of the UCM for different lubricating oils is important diagnostic features
  - The concentration or ratios of PAHs in used lubricants is useful in investigation spills
  - Petroleum biomarker ratios such as Ts/hopane or Ts/Tm offer the best opportunity to identify the sources of lubricating oils spill

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